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ABSTRACT

The introduction of computers into classrooms is one of the latest examples of educational innovation. It has been well established in the literature and in practice almost everywhere that teachers need to be actively involved in the development of teaching materials and aids needed to bring about educational computing in order to acquire a sense of ownership of the technology. If the use of computers is to be implemented successfully and to be sustained, teachers have to work out and develop their own sense of meaning in relation to the technology. They have to enjoy the same processes that are experienced by the students they are teaching. In order to build a successful teacher/student relationship, teacher training workshops aim to achieve either the confidence of teachers in using hardware and software relevant to classroom activities or to enable teachers to use the technology in classrooms to aid them as expert practitioners in their own field of knowledge. A number of case studies are evaluated encompassing national strategies, trends, and situations on the use of computers in the Arab world, in Western Europe, and in North America. (Contains 23 references.) (LL)

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"Implications for change in Teacher Education strategies offered by the new Information Technologies"

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Preamble

It is likely that educational historians will cite the last decade of the twentieth century as the dawn of a new age of learning and compare it with the introduction of universal books in the 15th Century. The rate of change in terms of new information technologies is difficult to comprehend, particularly when you are part of it and there appear not to be any clear reference points. One way to attempt to measure the rate of change is to think back 10 years and note what was available, compare that with what is available today and then try to extrapolate 10 years hence. You will, no doubt, be wrong and you will almost certainly underestimate the level of information technology capability available for learning. If we can dream about listening machines, sympathetic databases, solar powered portables and universal public access to knowledge then it is likely that it will happen. Are teachers prepared ?

Computers in Classrooms: The Rationales

One of the most important challenges in accretion is that of manpower development. In informatics, training qualified manpower in sufficient numbers has proven to be essential to its development. Hence the strong relationship established between informatics and education since the early stages of this new field. We take first à look at the Arab speaking world.

Almost all the Arab countries have introduced informatics as a subject in the second level of their educational systems. The main reason for this are:

the high costs incurred in spreading the use of informatics to lower educational levels;

the level of maturity of the secondary school students;

the serious deficiency in the manpower needed to teach informatics in the primary and intermediate level schools.

Detailed rationales are listed in literature for the introduction of computers in education in the Arab countries [Ref: 4,5]

Also, the use of informatics in the majority of Arab universities is similar in many ways to uses in universities in other world regions.

It must however be mentioned here that, during the last few years, universities in several Arab countries have launched educational and training programmes, as well as research and consultancy projects in order to help enhance the use of informatics in the educational systems of these countries [1].

In Western Europe and North America the picture is somewhat different. Although the subject of 'computer studies' or 'computer science' is still to be found on many curicula, it is usually offered as an option towards the latter stages of secondary education and the take-up is likely to be of the order of 10% of students or less. The current trend is towards a mix of 'computer awareness' for all students and the attainment of information technology capability by using computers throughout the whole curriculum. The implications for the re-training of teachers on a massive scale contained in that last aim are highly significant [23]. The real cost of teacher training in this area eclipses the cost of equipping schools with

hardware and software by a large factor. This cost is further exacerbated by the need for further in-service training as the technological developments accelerate. We can cite here the introduction of CD-ROM, optical disk, integrated media, satellite reception, electronic mail, portable laptops and virtual reality into the classrooms of the 'developed' world. At the one time we can recognise an exciting future for education but also a daunting one.

In developing countries, which tend to be grouped in Central Europe, South America, large tracts of Asia and virtually all of Africa, the picture is somewhat diffuse. Ministries of Education, by necessity, have to take an extremely pragmatic view when it comes to installing computers in schools. If the stark choice is between a better water supply in the village or a PC in the school (which might well not be wired for electricity), it would be a brave politician who would opt for the latter. Having made that point, there are many 'poor' nations which see the introduction of new technologies into their education system as a positive step which in the longer term will help them develop their industries, diversify their skills and create wealth. This view is supported by a number of international agencies, including UNESCO, the ADB, the ODA and the World Bank.

In summary, a number of rationales can be suggested [15, 20] that are adopted around the world. We cannot be critical. There is a logic behind them all and the boundaries may well be blurred. The priorities accorded by different nations will vary significantly to pander to their different needs.

These are:

Vocational study - preparing students for the workplace involving information technology;

Computer cognisance - raising awareness but few skills acquired, little in the way of hands-on activity and unlikely to be examined;

Improved learning and teaching - relies on students and their teachers having a lot of access to quality software (CAL) and powerful software tools;

Curriculum change - using information technology as a catalyst for bringing more relevance to the out-dated curriculum;

Elitism - producing a cadre of highly skilled and knowledgeable computer scientists which will impact on the scientific, commercial and industrial wealth of the nation;

Teacher replacement - little or no evidence to show effectiveness of computer compared with a teacher but the rationale still has its adherents;

Special Needs access to learning - much evidence to suggest that children (and adults) with special needs can be given a chance to communicate and compete on equal terms with the able-bodied.

The threat to the old order of the teacher - student relationship

The introduction of computers into classrooms is one of the latest examples of educational innovation. It has been well established in literature [2,18,19], and based on practice almost everywhere, that

unless teachers were actively involved in the development of teaching material and aids needed to bring about educational computing, and were therefore able to evolve a sense of 'ownership' of the technology, then such teachers would never form a clear understanding of that innovation and would therefore feel 'marginalised' from the technology and would see nothing worthwhile in its use. As a result, many computers acquired by schools were initially stored away in cupboards. If the use of computers is to be implemented successfully and be sustained, teachers have to work out and develop their own sense of meaning in relation to the technology. They have to 'enjoy' the same processes that are experienced by the students that they are teaching.

In order to build up and maintain a successful and balanced teacher-student relationship, teacher training workshops normally aim to achieve either of the following:

confidence of the teachers in using hardware and software relevant to their classroom activities. This, however, may 'de-skill' the teachers by reducing them to the position of a novice [2,21];

teachers use the technology in the classroom to aid them as expert practitioners in their own field of knowledge and then evaluate the educational outcomes. This type of training workshop is more successful since it places teachers as evaluators of innovation [2,18, 19].

As a consequence of the new order, a number of significant changes that are taking place in the methodology and content of the use of computers in the classroom are assessed.

A number of case studies are evaluated below, encompassing national strategies, trends and situations on the use of informatics in the Arab region [1].

The discussions are based on the reports published by UNESCO and other regional organisations [6,7,8,11] as well as the proceedings of several regional and sub-regional conferences which were held recently in the Arab region [7,8,12]. The summary of the findings is as follows:

Although almost all Arab countries have recently started to use informatics in secondary education in accordance with high-level policy decisions made by the respective Governments of these countries, it is quite noticeable that only a few of these countries actually possess national plans for the introduction of informatics into their educational systems [10].

Concerning teacher training in informatics, the following categories are mentioned:

Few countries were able to recruit teachers who have sound training in informatics (e.g. Bahrain, Qatar, Tunisia)

Other countries have opted for opening teacher education programmes in informatics at their colleges of education (e.g. Saudi Arabia, Kuwait, Iraq)

The majority of Arab countries have provided the teachers of other subjects (e.g. Mathematics, Physics) with training sessions varying between one month and two years after which they were asked to teach informatics (e.g. Iraq, Jordan, Egypt, Tunisia)

There was general concern for equipment and relevant facilities. All of the countries teaching about informatics provide premises especially fitted for computer use and these same premises are used for computing practice. For example, countries like Algeria, Iraq, Egypt have already invested significantly in the purchase of a variety of compatible hardware and in bulk quantities. There is also a great variation in the number of computers per school in each country. However, only a few countries have facilities for connecting computers within a local network at the level of each school (e.g. Kuwait, United Arab Emirates, Egypt)

Several Arab countries have established Computer Clubs for student hobbyists and projects (e.g. Jordan, Bahrain, Morocco, Kuwait... etc)

Hardly any Arab country is currently using informatics as a tool for teaching or learning on a significant scale [10].

Many Arab countries have already held many introductory teacher training workshops. However, the majority of these countries are still far from witnessing the participation of their trained teachers in educational software development teams. Regional co-operation among Arab countries appears to be the best possible solution to this problem.

In some countries, particularly in Western Europe and North America, the relationship between teacher and student is less formal than that established in the Middle East. We find more and more that teachers are considering themselves as 'learning enablers' and might deal with a threat to their knowledge know-how by actually saying to a student 'I don't know the answer but let's try and work it out together - let's see if.....'. The teacher loses no respect for dealing with a problem in this way. In fact, we can say that the teacher has turned the problem into an opportunity. Often, in a class, a teacher will find one or more student 'experts' on particular aspects of computing. Children have far more time than teachers to exploit particular features of the hardware and the software. An effective teacher will acknowledge the expertise and use it for the good of the whole class. These illustrations show that the threat is an imagined one and the issue is more one of good classroom management than that posed by the acquiring of technical expertise.

Pre-service (or initial) teacher training continues to be under-resourced in most developed nations. There is not room in this paper to look in detail for the reasons but suffice it to say that they are not all in the budget domain. Expectations on all sides are low and the following table giving figures for England and Wales [16] is not encouraging:

Priority given to Information Technology

%age of institutions	UFC	PCFC
High priority	7	12
Some priority	43	51
Little priority	47	37
Low priority	3	-

UFC - Universities Funding Council (30 respondent institutions)

PCFC - Polytechnics and Colleges Funding Council (51 respondent institutions)

Future prospects for the introduction and use of informatics in education

The use of informatics as an educational tool

Clearly, from the pedagogical point of view, there is considerable evidence that the use of information technology can enrich many areas of the curriculum. We can site creative writing, problem posing and solving, music composition, design, data logging, control, investigative mathematics and many more opportunities where IT differentiates the quality of learning.

Although the evidence is beginning to mount up, even the well-resourced nations such as Australia, Canada, the Catalonia

Region of Spain, Denmark, Norway, Singapore, Sweden, the UK and the USA are slow to mobilise their teachers and revitalise their curicula. England and Wales have taken the bold step of implementing a National Curriculum with information technology attainment targets for all pupils both within the Technology curriculum and also weaved through the areas of English, Mathematics and Science. It is early days yet, but there is a quiet confidence that this is the most likely strategy to effect change.

It is quite apparent that the use of the computer as an education tool is very limited in the Arab countries. In order to overcome this acute problem, it is recommended that regional or sub-regional centres are established.

The increasingly expensive requirements to develop courseware, software and training materials for this educational process, in any language, makes it essential that resources, know-how and products are shared in a complimentary fashion to ensure the long range growth and survival of informatics in the educational system of the Arab countries [12,14].

Teacher training on the use of informatics in education

Training should be provided to informatics teachers as well as to teachers of the various subjects who need to use informatics as an instructional tool. Both categories of teacher need to receive adequate initial (pre-service) training and complementary (in-service) training in order to be able to

participate in teams entrusted with producing and/or evaluating educational software [22].

Such 'adequate' teacher training will only be feasible through well established 'centres of excellence'. In the European Community, there is now a programme in place, called ERASMUS, to encourage the exchange of academics in higher education and the setting up of multi-national courses. The variety of spoken languages in the Community is a barrier for such collaboration, particularly when it extends to the software language as well. IT has not featured strongly in the programme. Some centres of excellence are emerging but they are few and far between, often with reducing budgets rather than expanding.

In many parts of the world, including the Middle East, a sub-regional network of centres could provide a part solution to the problem.

Software development and production

Some nations, for example France, Norway, Portugal, Scotland, Spain, Sweden and Wales have financed educational software development centrally. Others, such as Australia, Belgium, Brazil, Italy and the USA have left the development and dissemination to market forces, largely within the private sector. Whatever system is in place, and this depends largely on national politics, along with the necessary training, it is important to create a structure that would promote the

development and use of educational software. It would be quite inappropriate to use the computer for programming purposes only, although this temptation is an understandable one when quality software is rare. It can be argued that the development of a range of educational software should be treated as high priority in all nations embarking on a serious strategy for computer education. The teams entrusted with these tasks will consist of computer professionals, educators and teachers of the respective subjects in the school curicula. The cost of this activity is not inconsiderable.

A closer look at the situation in the Arab world bears interest. Although the advantages afforded by the multi-national use of Arabic would seem obvious, the problem of dissemination and documentation of mother tongue software (including educational software) is a real problem which is difficult to solve. Therefore, particular attention must be paid to this issue as it necessarily affects the efficiency of the work of users of informatics in schools (being either students or teachers of the various subjects).

In 1988, the Arab Fund for Social and Economic Development (AFSED) approved the funding of a project for the establishment of two regional centres for the development of Arabic educational software and Arabic administrative software, development of Management Information Systems (MIS) and Software Automation respectively. One centre has already been launched in Cairo (January 1992), Egypt dealing with

Software Automation and MIS, the other two centres are yet to be launched in Kuwait and Tunis.

Given the extent of the software problem, it would be advisable to organise exchange programmes among the Arab nations and between the Arab speaking world and other regions, for example, Western Europe.

This argument can be replicated in all regions. The European Community is embarking on an ambitious scheme this year to create a European Pool of education software. The scheme is simple in concept. Each nation contributes two quality packages to the Pool and each nation can take out around 20 packages. The more difficult aspect is that of language translation (software and documentation) and adapting to local curriculum needs. By stipulating an MS-DOS or MS-Windows platform, the problems of versioning for a variety of operating systems have been avoided.

Research Work

Educational research work is most of the time carried out early in the process of introducing informatics in education. It will have to be recognised, promoted and developed so that local needs may be better determined in order to pin-point the objectives of training. Educational research work can be linked to the above-mentioned incitement structure for software production. It will also have to include an assessment of the educational software used.

Evaluation

The last problem raised is not the least important. Regardless of the objectives set and the modalities adopted for the educational software production and the teacher training, it is necessary to assess the efficiency and continuity of such systems through the use of various evaluation measures [7].

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